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LINKING THE DOUBLE HELIX OF LEARNING AND WORK TO THE TRIPLE HELIX OF UNIVERSITY – INDUSTRY – GOVERNMENT IN THE EUROPE OF KNOWLEDGE

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Abstract. *The present paper presents results of research in progress. Its purpose is to highlight the relevance of the helix logic for the understanding and speeding up of the processes of innovation and learning in the knowledge based society with a particular emphasis on the European higher education and research area, more specifically Romania. Two representative models are presented and considered promising for their applications in education and research strategizing: the „Double Helix" of Learning and Work and, respectively, the „Triple Helix" of University-Industry-Government. The paper is based on (1) the authors' experience in Romanian higher education, from various university management positions to government positions related to higher education and (2) the author's experience of dealing with the business environment during the transition, experience encompassing areas from policy generation and implementation to evaluation of projects and research. This experience is captured by a critical exploration of the realities addressed in the paper and turned into an academic piece of qualitative research by using the conceptual artefacts approach. The specific difference the paper presents consists of providing a common framework for analysis for the two models which are based on the same logic, but were developed in different contexts both from a conceptual and an operational point of view. The paper also puts forward the hypothesis of the convergence of the two models with arguments that contribute to including the issues presented on the research agenda of the sociology of science and the theory of the policies fostering learning and innovation. The conceptual limits of the Triple Helix model are underlined, as well as the distortions that might appear during the implementation under real conditions of the partnership for innovation among universities, industry and government. Some elements of qualitative diagnosis of the degree of Romania's readiness for the adoption of the Triple Helix model are also presented. The paper puts forward the proposition for the convergence of the two models for further international research and study with the very practical view of finding means to render this proposal operational at both institutional and strategic levels.*

Keywords: double helix of learning and work; the triple helix of university – industry – government; emerging economies; university governance; higher education quality; triple helix of university – industry – government.

1. Introduction

It is a widely accepted fact that mankind is engaged in a knowledge revolution. This is of planetary proportions and it has a limitless horizon, from the point of view of both time span and range of themes. We share Dahlman's opinion

(2002), according to which the key elements of the knowledge revolution could be the following:

– Increased codification of knowledge and development of new technologies;

– Closer links with science base, increased rate of innovation, shorter product life cycles;

– Increased importance of education, up-skilling of labor force, and lifelong learning;

– Investment in intangibles (R&D, education, software), greater than investments in fixed capital in OECD;

– Greater value added now comes from investment in intangibles such as branding, marketing, distribution, information management;

– Innovation and productivity increase more important in competitiveness and GDP growth;

– Increased globalization and competition.

Though emergent in its initial manifestations, this process has started to gradually induce impulses appropriated by a wider variety of stakeholders becoming thus the object of the programmatic steps of giving it a desirable course of action and a favorable impact, through its results.

The most representative form of intervention of this sort is represented by the scientific and technological policies at national level, initially promoted by the developed countries of the world, but which, in the last decade, have significantly extended their application area, both top down and bottom up; thus, on the one hand they have „descended" both regionally and even locally, and on the other hand, they have ascended to international prominence, involving composite actors such as the EU, OECD or UNESCO.

The emergent character of the scientific and technological revolution explains its perceived hyper-complexity, which, by its nature, can determine limitations of the prediction capacities belonging to the relevant stakeholders of this field. This kind of limitations manifest themselves both in relation with the time framework, in the sense that they make medium and long-term approaches relatively difficult, but also in relation with the possible degree of accuracy to perceive tendencies and to set objectives.

The fact that such limitations are actually inevitable is also demonstrated by the experience of adopting and implementing the Lisbon Strategy at a European Union level. The Lisbon Strategy set as its fundamental objectives promoting economic growth and employability with a view to develop a Europe of knowledge – a fundamental objective that the EU had acknowledged several years before. (Commission of the European Communities, 1997)

Still, one can notice that, in its original form (March, 2000), the Lisbon Strategy was rather an expression of optimistic expectations, defined as targets to be achieved in a ten year period. At that moment, we would have expected the „structural resistance" of the Lisbon Strategy to reside in its own objectives and the subsequent

methods – especially benchmarking and open-system coordination – to remain as operational auxiliaries of the process.

Nevertheless, in a way things have evolved in a relatively opposite, unforeseen direction: the very benchmarking and open-system coordination instruments were those which became stable and have been adopted by the current practice, while the targets suffered a revision, at least compared with their initial launching.

Thus, the declared objective of the initial version of the Lisbon Strategy was formulated in the sense that the European Union has *„to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, with more and better jobs and greater social cohesion"* (European Council, 2000). In the revised form of the Lisbon Strategy, which continues to focus on „growth and employment", the objective is reformulated in the following terms: *„Europe must renew the basis of its competitiveness, increase its growth potential and its productivity and strengthen social cohesion, placing the main emphasis on knowledge, innovation and the optimization of human capital"* (European Council, 2005).

This change does not limit itself just to the terms used, but it also uses a new way of thinking, eloquently illustrated by the report *Facing the challenge. The Lisbon strategy for growth and employment* (Kok et al., 2004).

To be successful in the new global and European economic and scientific contexts the actions triggered by the above mentioned challenge need to involve all the forces available in the European Union. Progress has to be made at the level of each objective and of each actor while the process has to be continuous and targeting the highest level of productivity, increased added value and high degree of turning into account the production factors within an ecologically effective economic system.

As expressed by the group of experts (Kok et.al., 2004), „Europe needs to inovate on its own behalf. The strength of its knowledge industries and Europe's capacity to diffuse knowledge across the totality of the economy are fundamental to its success and are key to lifting its growth of productivity to compensate for falling population growth and pay for its social model".

In the case of the groups of experts, the consensus stated in the terms of a joint effort is formed according to significantly different rules from the ones on which the consensus is based as a commonly negotiated platform among the decision makers. Using the contributions of the experts one can obtain answers to multiple challenges and find the right path, the right speed and the best means to reach an agreed target. Not using professional and independent analyses can lead to strategies that refer to everything and nothing in particular, and to actions for which all actors are responsible but none of them actually do anything. Experts offer evaluations, solutions and recommend ways of speeding up the process of promoting initiatives; they have the important skill of being impartial towards the realities, of proposing actual objectives

and not general ones, they are the advocates of clarity and simplicity, they make their statements exact and rely on a relevant reality.

The Kok Report shows that the knowledge-based economy requires a new definition for the role of science and innovation in society all public or private actors being called to contribute to this process. „Lisbon *aims to raise private and public research and development spending as the centerpiece of the concerted efforts to increase the creation and diffusion of scientific, technological and intellectual capital" (*Kok et al., 2004*).*

At present, inside the European Union, one can observe the generalization of the practice of forming teams of expert, whose reports ensure the substantiation of the main decisions in science, technology and education, agreed upon by the deliberative European forums; this kind of reports starting from emphasizing the main aspect of the reached stage and the trends that manifest themselves in a certain field, foresee new initiatives or recommend necessary alterations.

Another answer to the challenge of hyper-complexity is that of emphasizing the prospective research concerning the development of science, technology and innovation, promoted in a European framework by the Directorate General for Joint Research Center of the European commission (FISTERA, Prospective Foresight Network, PRIME, etc) and also by universities and by NGOs.

It is worth mentioning that the first to stimulate synthetic-prospective approaches were the domains with the highest dynamism from an innovative and applied point of view, such as the Information Technology Society (Bangeman, 1994) or the field of education and professional training (Delors et al. 1996).

The characteristics of the present global revolution of knowledge and, in particular, the specific context of the knowledge-based society which is emerging in Europe-27, underlines the importance of the *helix logic* in understanding the mechanisms of the progress of contemporary science and of its applications based on the two fundamental processes: *innovation and learning***.**

In this context, Gibbons introduces the concept of „academic revolution"; „… the First Academic Revolution was about adding the function of research to the two other functions of the university, that is preserving and transmitting knowledge. By contrast, the second revolution considers another major change in the mission statements of universities, a change that would make participation in the process of economic development into a core value." (Gibbons, 2000)

Starting from a brief analysis of the helix logic, presented in Section 2, the present paper examines the relevance and utility of „he Double Helix of Learning and Work" (Malitza, 2000; Giarini and Malitza, 2003) and, respectively, „the Triple Helix of University-Industry-Government" (Etzkowitz, 1995; Etzkowitz and Leydesdorff, 1998). Sections 3 and 4 will present each model with their main characteristics in terms of conception and applicability, while Section 5 will examine the two models in correlation to identify possible points of convergence between the two.

The conclusions of the paper sum up the arguments presented in supporting the idea of a convergence between the two examined models at the same time suggesting that this convergence should be made operational through their integration and by adopting them as referential to develop policies and to pilot reformation processes, through integrating the contributions of experts.

2. Brief presentation of the helix logic

The process of developing new knowledge inside the contemporary organizations was represented, in the last decade's literature, by adequate metaphors, among which one distinguishes itself through its fertility, *the helix metaphor*. Thus, Nonaka and Takeuchi (1995) proposed a *knowledge spiral* that aims to explain how individuals and groups convert knowledge from a tacit to an explicit form and vice-versa, and share both tacit and explicit knowledge. Subsequently, this model was developed by Nonaka, Toyama and Nagata (2000).
Other relevant examples in this field are represented by the KMOLI helix put forward in order to approach the processes of managing knowledge, organizational learning (McLean and Page, 2003) as well as the hierarchical helix, destined to shaping the process of managing knowledge (Sun and Hao, 2006).

In this context it is proper to underline the richness of meanings the helix logic puts forward which explains its utility for the understanding and for the designing of processes of knowledge, such as innovation or learning. Essentially, the helix reproduces an upward evolutionary path, with an unlimited continuity perspective, in which the reaction loops do not tend to close in the form of the classic feed-back but act as virtuous circles. The adoption of this logic corresponds to a circular approach in representing the cause and effect relations, thus going beyond the linear reductionism specific to normal science founded on the positivist paradigm; still, the evolution of the helix does not mean cyclicity because, in the former case, the advance that takes place is irreversible and self-enhanced, while, in the latter case, its evolution is simply repetitive. (Dragomirescu, 2007).

Applications of the helix logic can be found in the processes oriented towards placing science at the service of the individual and the society on the whole, so that the Scientific and Technological Revolution should have as a correspondent not only a high-tech infrastructure, but also a knowledge-based society (Drucker, 2001), both in the sense of an innovative, learning society and as a networking oriented one.

From the perspective of the spiral logic there are two representative models that are relevant both for the reform of higher education within the Bologna Process and for enhancing research at the level of the European Union: „The Double Helix of Learning and Work" (hereinafter referred to as „Double Helix"), put forward by Malitza (2000) and developed by Giarini and Malitza (2003) and, respectively, „The Triple Helix of universiy-industry-government" (hereinafter referred to as „Triple

Helix"), put forward by Etzkowitz (1995) and developed through the contribution of Etzkowitz and Leydesdorff (1998). The two models appeared in relatively different cultural and operational contexts, but they have the same dominant logic, presenting a series of common complementary features and targeting common objectives allowing us to launch the hypotheses for their convergence.

3. Learning and work in the new economy: the „Double Helix" Model

In the last decade there has been a shift both in the political discourse and in the academic research from the process of education and implicitly of teaching requiring external intervention from a whole system, towards the learning process learning which is a profoundly individual act (Peter and Humes, 2003). The very goals of education and the means to achieve them are being re-examined: „Does education serve the needs of society or those of the individuals? Does education focus on the knowledge object or on its subject?" (Giarini and Malitza, 2003, p.16). The system of education finds itself confronted with issues that relate to the very redefinition of its mission. It thus evolves from a traditional activity of transfer of knowledge to one of training and developing competences and meta-competences.

Related to the requirements of the new economy education becomes a system of integrated activities in which people learn how to learn and, also, learn how to operate with the knowledge they have, consolidating and developing it. The change that arises in the mission of the contemporary education system is, essentially, related to the extremely dynamic process of renewal and restructuring of scientific knowledge in all fields. There is no logic in education requiring people to learn things that are inevitably doomed to change. What education is required to deliver are methods of learning and internalizing viable and durable cognitive structures and practices.

If in the industrial age initial training was enough for the length of one's whole career, in the information age, conditions have changed dramatically and professional training turns into life long learning overlapping with the individual's whole active life which means that the same person will be repositioning itself permanently from the point of view of professional qualifications and, implicitly, of the jobs in one's career.

Another issue of major interest in the present conditions is that of educational profiles and subjects. Traditional education, specialized and structured around subjects or group of subjects, produces graduates more and more challenged by the requirements of ever increasingly interdisciplinary practices. Under these conditions knowledge acquired during one's formal education period is inevitably related to the very demanding standards of reality. The above changes of perspectives are summarized and presented in Table 1.

Table 1

Challenges of change in contemporary higher education

Learning		Necessary Changes in Teaching for Backing the New Learning Type
Conventional	Required by the New Economy	
One-off, discrete courses, non-secvential	Continuous activities	Emphasis on how to learn, how to ask questions, how to access information, developing critical thinking
Knowledge transmission, greater tutor leverage	Skills transmission, „bitty" modules	Theoretical knowledge complemented by experiment and experience
Institutional, formal, timetabled teaching	Dispersed, Informal, any time - any place learning	Flexible and responsive approaches to teaching, in accordance to the characteristics of learners
Simulations	Improved "practice" preparation	Improved course management
Asynchronous	Lifelong learning	Audience-oriented teaching discourse
Teacher-driven, for individuals, exclusive	Student-driven, group learning as a social activity, inclusive and pervasive	Interactive methods of teaching
Courses delivered „ex-cathedra"	Online search, online quizzes, network groups	Adapting teaching and evaluation to the new media.

Source: Adapted by the author based upon Peter and Humes, 2003.

Originally, the idea of the helix logic in modelling the relation between work and learning is found in the article published by Malița (2000) later on developed by Giarini and Malitza (2003) who put forward „The Double Helix of Learning and Work" project for the scientific community with a view to introduce a systemic reform in education at global level.

„The Double Helix" Project aims at a restructuring of education to the needs of the 21st century along the two main axes: curricular moduling and the operationalization of the „life-long learning" principle. The authors start from the idea that education represents not only a consequence of previous economic development, but also a precondition of the future economic development. The human resource capitalizes *a set of useful skills and abilities* obtained in the process of formal education and professional training. The wealth of future and present generations depends on this human capital. Consequently among the strategies of economic development priority should be given to training the human resources.

The research of Giarini and Malitza offers answers to a series of questions such as: „How can we assure that, in our modern, highly complex and demanding

service economy, the right knowledge and understanding is within the reach of the employees? How do we guarantee that they will be able to perform the tasks that they are assigned up to the highest standards? How do we keep organizations in shape through to the adequate accumulation of efficient human capital and its constant adaptation to changing circumstances? How do we resolve the dilemma caused by the need to obtain knowledge and the capacity to perform (learn), on one hand, and the obligation to apply what has been learned (work) on the other?" (Giarini and Malița, 2003, p. 16).

The requirements of the post-modern age suppose the creation of new reference points when redefining job contents and reconfiguring the relationship among education, training and actual on-the-job activity. Mircea Malița states that „*when you do work based on knowledge, you learn*" (Malița, 2000). Today's economy acknowledges as market leaders organizations which succeed in practicing a high-quality „learning" at an individual and organizational level. The „Double Helix of Learning and Work" project considers that all forms of education – formal, informal and non-formal are important. In its present stage, formal education has certain limits such as: insufficient flexibility of the curriculum, frequent overlaps and discrepancies between the different curricular components. The suggested solution for this challenge is module distribution**,** a process that is based on a new type of convergence between learning and work. The „Double Helix" Project puts forward the following propositions:

– Learner centredeness with the special mentioning that in this new model the subject has a proactive role;

– Practical sollutions to operationalize the „Lifelong learning" principle by alternating the periods of work with those of learning;

– The connection between the „Learning" helix and the „Work" helix stimulate skills training and, at the same time, the practising of skills acquired during training and education by working;

– Avoids job-rusting: every moment there are new challenges and opportunities to continue learning and to apply it;

– Curriculum modularity meant to ensure:

- Personalized educational tracks according to the needs of the learner;
- Solving the contradiction of the traditional curriculum format with clearly defined disciplines and the requirements of the job related practices which require a high degree of interdisciplinarity;
- A high degree of professionalization through skills training and development through which the learner becomes gradually skilled and even expert in a certain area.

Resorting to curriculum modularity means parting the subjects into small but compact modules, homogeneous from a thematic point of view, which would lead to avoiding the repetition of some knowledge elements, reducing informational redundancy, diminishing confusion determined by different ways of approaching the

same topics in different learning subjects. Curriculum modularity becomes the way through which one can promote inter-disciplinarity – an essential condition for the educational and professional training programs specific to the knowledge-based society. Among the advantages of curriculum modularity one can mention: facilitating the thematic integration process, emphasizing the knowledge-intensive character of the new thematic domains, redefining the role of the means used by the trainers and offering new basis for the sustainable restructuring of higher education. Under these conditions, the beneficiaries of the education and professional training processes will have better grounds for understanding the options for their best career path, they can accumulate and capitalize integrated knowledge and abilities as competences and training periods can alternate with working ones, depending on each individual's aspirations.

The „Double Helix" Model of Education and Work can turn into a solution for the complex challenges that the higher education systems have to deal with, more and more often acknowledged within UNESCO, the Bologna process and national debates around the reforms of universities. In the case of Romania the process of transposing the values of the Bologna Process into practice was a beneficial opportunity within the frame of the general reform processes of the economic and educational systems. Ensuring quality to the education programs, elaborating the national frame for the higher education qualifications, increasing university autonomy and modernizing the academy governance, the intra- and interuniversity mobility of the university community members, adapting graduates' competences and knowledge to the labour market requirements were objectives of the reform processes and basic components of the educational policies.

Though a just correlation between stability and change was highly necessary within this process, practically the conservatism of the system prevailed and limited the potential for change. Three years from the start of the reforms at national level, the Romanian higher education system, managed to align itself to the principles of the Bologna Process, mainly under a structural aspect (cycles, specializations) and with providing the supportive institutions (agencies, national authorities, centers, etc); the adaptation was made, in a less significant way, under aspects regarding content and quality, which are key factors both for the good functioning of the Romanian system and the other national higher educational systems from the countries that participate in the Bologna Process.

4. The „Triple Helix" model: general characteristics and readiness assessment of the Romanian context

The „Triple Helix" model can be defined as a partnership for knowledge and, consequently, may exercise a main role in the future development of the knowledge society in Europe and the world. The main elements of the „Triple Helix" model could be located within the Scandinavian countries well-known internationally for the

quality of their policies and results obtained in innovation. Thus, VINNOVA, the Swedish agency for innovation, adopted the „Triple Helix" model with a view to offer effective solutions for the issues related to the generating, transfer and use of new knowledge (Etzkowitz, 2002). This model integrates the actors from research, from business and government. The first category is made up by researchers concerned to apply the new concepts, models and instruments that they are developing and universities which conceive their educational programmes oriented towards training the new competences of the future graduates. The second category is formed by the decision making factors from the world of business (entrepreneurs, investors, executive managers) who have the capacity to realize the economic importance of the new developments in knowledge, to foresee the demands on the market, to assume the opportunities and the risks in applying the new conceptual and technological solutions as well as to initiate and run business projects while waiting for the effects of the investments in knowledge. The third category is made up by the decision making factors from the state legislative and executive institutions which legally regulate the conditions for the functioning of businesses, of research centers and universities, allot public funds for research and development and for education while at the local levels facilitate the setting up of new companies and look after citizens' welfare.

One can notice the correspondence between the elements of the „Triple Helix" model and the ones of the negotiated economy model which appeared in Norway and is being used in the Scandinavian countries. Rychetnik (1995) raised the question whether other countries, such as the ones in Central and Eastern Europe, with emerging economies are also likely to adopt the model of the negotiated economy. His answer is affirmative in the case of the Czech Republic and not very firm in the case of Slovakia. It can be inferred from here that the triple Helix model could be considered as a core around which systems of negotiated economy could be also developed in countries with emerging economies. Paradoxically, however, in places where confrontational logic prevails there are very few chances for the system of negotiated economy to be applied even though it appears to be the most rational solution.

Evaluations of reasons to seek partnership between firms and universities were proposed by Lee (2000), the most important reasons for partnering being: access to new research, development of new products and maintaining a relationship with the university.

More recently, Bornstron (2008) highlighted a set of four categories of rationales for firms to cooperate with universities on research and development (R&D), namely: cooperation outcomes for product and process development; access to academic networks; human capital management; direct business opportunities. *„Most firms or firm subunits have several rationales for cooperation that may cause the firm to either set up different projects to meet each need or to try to find project designs that allows them to benefit from several types of cooperation effects at the same time (in fact, the latter choice is richly illustrated by the material at hand). Similarly, a firm*

*seeking effects in one category may find that the cooperation brought about unforeseen effects in other categories" (*Bornström, 2008). As Broström and Lööf (2004) show *„Approximately 25 percent of these firms collaborated with universities on innovation projects. The results show that the knowledge transmission between university and industry has a significant and positive impact on the firms' R&D investments and innovation performance"*.

The „Triple Helix" Model presents specific advantages for each of the three categories of the involved actors. Thus the application of the model by businesses and industries helps *expand long term and risky research activities to experts in the field; obtain proprietary technology through licensing; agreements; leverage funding through matching grant projects; collaborating research labs are source of new recruits.*

For universities and research organizations, the adoption of the „Triple Helix" Model could ensure:

• *Excellent sources of funding with industry and government sharing the load;*

• *Funding allowing for critical mass of personnel and in general more efficient research;*

• *Training of highly qualified personnel in industrial related research good for job placements;*

• *Helping remove stigma of „ivied walls";*

• *Research generally based on strategic needs with long range benefits to the community.*

For public authorities the interaction with the industry and the university as it is put forward by the Triple Helix Model could have some of the following effects:

• *New industries and new products can lead to higher employment;*

• *Financial benefits from taxes and duties;*

• *Helps support strategic R&D initiatives;*

• *Many products could be providing a better live style.*

In the knowledge era, there is a natural phenomenon of mutual learning and adaptation that takes place among the three actors, government, companies and universities, with a view to creating a friendly interface during their interaction. Research consortia get companies and universities together to help promote a common theme. The teaching staff offer consultancy to companies while the companies co-finance projects together with universities. From companies universities learn what entrepreneurship means. The very concept of „entrepreneurial university" has its origin in the space of the „Triple Helix" Model. In their turn companies learn from universities both how to train their own employees and even their customers and how to manage knowledge. Many large companies have adopted the concept of „corporate university" internalizing capabilities of advanced training for their own employees. For example, Microsoft set up its own college level training facilities without considering, nevertheless, that it has become self-sufficient from this point of view (Davenport, 1998). Having to deal with the limited capacity of Finnish universities to

train specialized engineers, Nokia set up its own R&D centres, placing them in Central and Eastern Europe, either in university campuses or on industrial platforms thus benefiting from the local expertise (Leger et al., 1998). The interaction area among universities and industries mainly includes technology parks, innovation clusters, business incubators, mixed academy-industry research centres and spin-offs.

Lately issues related to the „Triple Helix" Model have been studied from a pragmatic perspective, including institutionalization (Benner and Sandström, 2000), measurement (Meyer, Siniläinen, and Utecht, 2003), improving the flow of information among the three categories of actors (Leydesdorff, 2003) or, respectively, increasing performance in dealing with them (Hellström and Jacob, 1999). The „Triple Helix" Model has also been studied in specific, cultural and geographical, contexts including, through comparative studies, the importance of the regional dimension: the studies on Japan and Singapore (Baber, 2001) or Latin America (Sutz, 2000). The advantages of the use of the Model and its implementation scenarios have been critically evaluated. Criticisms expressed were directed either towards the very conception of the Model or towards the possibilites of its implementation under real conditions. As far as conception is concerned, the „Triple Helix" Model is criticized as being too abstract (Cooke, 2005). At the same time there is a relative fuzziness in using concepts which arise from „borrowing" the model from genetics where the unit of analysis is the cell.

The main conceptual weakness of the „Triple Helix" Model admitted to a certain extent even by its promoters and highlighted by its critics refers to the significant differences between the system of regulations on the basis of which the industrial, academic and government entities function. Thus, companies practice a logic of the equivalent exchange while universities – one of non-equivalent exchange. There are also differences among the decision making systems and practices: each category of actors operates with rules, criteria and decision making methods determined by their institutional characteristics. For example, the relation between the academic environment and the political decision making is similar to the separation between politics and science underlined among others by Šlaus (2003). It is indeed difficult to create a framework in which synergy can be generated through the actions and interactions of governmental officers, having a limited mandate and functioning within more or less bureaucratic institutional structures, representatives of the economic environment, with their fundamental interest of profit maximization and members of the academic community, concerned more with ideas, innovation and latest methodologies and than being acquainted with the regulations of public institutions and the specific constraints of the business world.

As far as the model's applicability is concerned the recent literature critically evaluates the difficulties of implementing the model as well as certain limits to which its operational performances are subjected. Thus Brännback et al. (2008) expressed their reservation towards the „Triple Helix" Model in relation with the regional systems of innovation showing that the model *confuses the individual with the system*

when discussing innovation. The same authors show that many initiatives to promote the „Triple Helix" Model have failed because the *entrepreneurs* (full of initiative, organizationally structured and having the decision making mechanism) and the *innovators* (scientists from the academia, researchers) have been unwilling to also associate the governmental actors as well therefore wasting valuable synergetic potential. As far as the role of the state as sponsor continuous to decrease there is the risk, particularly in applied research, that the contract stipulations limit the role of universities in the dissemination of knowledge. One of the solutions could be the guiding of the state financing towards applied research within a framework that allows the dissemination of results towards companies but also the use of results in the training activities by universities. In many cases the representatives of the government or of the business environment meet and discuss only with the leadership of universities or of the member faculties and only very rarely with the teachers or researchers themselves. The assumption is that if the university administration leaders agree upon a certain partnership all the members of the university community will, implicitly, share the values promoted through the respective agreement and will start immediately to implement them. The representatives of companies believe, in their turn, that the national innovation systems are strongly centralized, represented by numerous institutions in which bureaucrats do not understand the specific issues of the business world.

The „Triple Helix" Model mainly promotes the partnership among consolidated structures (government – businesses – academia) explicitly non-integrating the smaller or the individual actors with the implicit understanding that these latter ones have fewer chances to promote this philosophy. The studies of Zucker et al. (1998 and 2002) have shown, on the other hand, that if small businesses are located in the neighbourhood of important, prestigious scientific institutions they are more successful. At the same time, scientists working in the proximity of innovative companies become more peformant and get publicity at an earlier stage in their careers due to the fact that they receive messages from the economic environment more rapidly and, thus, need to face challenges and to solve specific problems.

In the particular case of Romania, the following evolutions can be mentioned during the pre-accession period to the European Union in relation with the elements of the triad government – universities – companies:

- privatizing state companies and setting up a sector of new private businesses mainly through foreign direct investments;
- the appearance and development of private universities;
- the restructuring of the system of research organizations and the stimulation of university research.

„For the Romanian HES there were three major challenges: adaptation to the new market economy, integration in the European Area of Higher Education through the Bologna process, and upgrading of its leadership and management to a knowledge society" (Bratianu, 2008, p. 22). During the period 1990-2007 relevant changes have

taken place at the level of institutional and legislative framework, but with important differences between the pace of reforms in higher education as compared with those in the worlds of business or public administration. Intense and simultaneous processes of *job destruction* and *job creation* have been registered, as well as a massive orientation of youths towards higher education in parallel with the process of brain circulation.

At present, Romania is lagging behind the majority of the European Union member states as far as the operationalizing of the „Triple Helix" Model is concerned. The Romanian society has the elements of the „Triple Helix", but they are not yet articulated in a unitary, functioning system, and the consequences of the transition exacerbate some intrinsic limits and constraints attributed to the model.

Although the declared goal of the „Triple Helix" Model is to consolidate the interaction among the actors involved in an authentic and dynamic system of innovation the realities –in the case of Romania as well – are quite different. The actors, though interacting, are far from creating a synergy, sometimes operating in parallel worlds. The actors of one category have sought either for survival solutions or for tactical advantages in the bilateral relation with a third category, as a means of compensating deficits and breakdowns in the relations with a third category. For example, considering that public financing has been insufficient universities started to compensate it developing the relation with companies. On the other hand the decrease in the activity of the research institutes financed by the government stimulated businesses to resort to universities to solve issues of applied research and technological development.

The relation between government and the business environment: after almost 50 years of planned economy, the transition to the market economy and the right of law, based on the pluralism of ownership forms and of the political options had as an effect the self-limitation of the role of the state alongside the increase of the autonomy of companies and universities. Privatization was considered by the state as an opportunity to get rid of the burden of inefficient firms that were in its propriety. However, an analysis of the important „successful" privatizations shows that a large number of long and medium term costs (compensatory salaries, preserving of active assets, de-pollution, professional reconversion, de-structuring of the pre-existing supply chains) had to be covered by the state. These additional costs may explain, at least partially, the insufficiency of public funding that could be redirected towards research and education in Romania.

The relation between government and universities: Although in Romania there are at present 27 accredited and 26 provisionally functioning private universities, the largest part of the national system of higher education is still in the public domain. The state is still perceived as a sponsor, having not become a facilitator yet for partnerships between universities and businesses, as it should be necessary and as it actually happens in the more developed countries.

The relation between universities and businesses: at present most companies are privately owned while the majority of universities are public. Research contracts

signed by universities with businesses are still perceived as deprecating and the object of such a contract is considered rather opportunistic than strategic. The public-private co-financing situations of some research projects represent rather the exception than a model to follow. Intellectual property rights are not yet clearly addressed and structured which makes the transfer of technology difficult and the possible spin-offs appear as centrifugal evolutions in relation with the universities.

5. The convergence between the „Double Helix" and the „Triple Helix" Models

The hypotheses of the convergence between the „Double Helix" and the „Triple Helix" Models makes sense if we start from the necessity of correlating the two models so that the Bologna Process should benefit from their coupled advantages. There can be evidenced, however, aspects which justify the possibility of this convergence. We consider that these aspects are implicitly determined in both cases by the logic of the spiral, becoming yet manifest if the two models are considered in an evolutionary perspective.

The dynamic character of the „Triple Helix" Model (Leydesdorff and Etzkowitz, 2001) refers both to the relations among the three poles and their performances and to the possibility of reconfiguring the model in the sense of its expansion. New elements, such as the territorial coordinate, have been suggested for inclusion in the „Triple Helix" Model or even a fourth spiral considered to be the public, in other words the citizens. Etzkowitz and Zhou (2006) proposed *„a Sustainability Triple Helix of university – public – government as a complement to the Innovation Triple Helix of university – industry – government, thereby introducing a missing element into the model, while retaining the dynamic properties of a tertius gaudens"*.

Along the same lines of thought Vavakova (1997) suggested the necessity of a new social contract between governments, universities and society. The connection with the „Double Helix" Model will be made through the variable represented by the „civil society".

The convergence between models could conform to the analogy according to which the Triple Helix is the ***hard dimension*** while the Double Helix is the ***soft one*** in the sense introduced by Romer. Convergence supports and confirms the progress of the knowledge society.

6. Conclusions

If the Bologna process is considered from a descriptive point of view it takes the form of a catching-up process while educational policies and university governance might be exposed to distortions and imbalances under the form of *vicious circles*.

The alternative for the European context may be the fine-tuning of the national educational systems. We consider that the „Double Helix" and „Triple Helix" models can be utilized in this sense.

The two models are compatible and can become convergent. The possibilities of their integration, both at a conceptual and at an operational level, justify the placement of the issues on the agenda of related international research. If jointly applied, the two models allow the formation of *virtuous circles* which are meant to support the enhancement of the quality of the higher education processes Europe-wide, and also worldwide.

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